*ALSTON** MODEL 566/SONDS

DATA COLLECTION TERMINAL

1. GENERAL

1.01 This is a cover sheet for the Alston Model 566/SONDS Data Collection Terminal (DCT) instruction manual, Section 80566. Pacific Telephone Engineering Letter (PTEL) 2271 authorizes the use of this equipment in Pacific Bell and Nevada Bell.

1.02 (Reserved for future use.)

1.03 The Alston Model 566/SONDS is a microprocessor based DCT with triple data memory of 200 register capacity with up to 1920 inputs. The inputs are made up of 200 "ones" leads that may be used for either peg-count or usage (one second), and up to 1720 leads pre-grouped with eight leads per group that can be used for usage data only (10 seconds).

1.04 This DCT employs a "Personality Map", Programmable Read Only Memory (PROM) which defines its operating characteristics for each particular installation.

1.05 If corrections are required in the manufacturer's instruction, use Form E 3973-1PT as described in Section 000-010-901PT to process the correct information.

1.06 If equipment design and/or manufacturing problems occur, refer to section 010-700-011PT for procedures on how to file an Engineering Complaint.

1.07 When revised instructions reflect changes due to modification of equipment, retain the superseded information until the equipment is modified.

Note: Equipment shall ***not*** be modified without approval of the District Staff Manager-Maintenance Systems.

2. MAINTENANCE

2.01 Field repairs involving the replacement of components within a unit shall ***not*** be made without authorization from the District Staff Manager-Maintenance Systems.

3. ORDERING PROCEDURES

3.01 This equipment may be ordered using Form P 505-FA through the Sector Plug-in Administrator (PIA).

4. REPAIR/RETURN

4.01 Units that require repair or replacement should be returned to the Sector PIA for normal processing.

* ***Registered Trademark of Alston Division of Conrac Corporation***

Attachment:

Alston Division, Traffic Recorder Instruction Manual, 80566/SONDS, Issue 2, October 1980

MODEL 566/SONDS
TRAFFIC RECORDER
INSTRUCTION MANUAL

1. GENERAL

1.001 This addendum is a supplement to the Model 566/SONDS Traffic Recorder Instruction Manual. This addendum is issued to make updates and corrections to the technical data in the manual.

2. CHANGES TO THE MANUAL

2.001 On page 16, replace step (a) of paragraph 5.05 with the following:

(a) Location 615 specifies the boundary between peg count and usage for the "ones" inputs. This boundary may be set to any "ones" input number. All numbers below the boundary will be peg count, and all numbers beginning with the boundary number and above will be used for usage. The standard setting is 80.

2.002 On page 18, Table E, replace the information provided for Location number 615 with the information in this addendum.

2.003 On page 31, replace paragraph 1.03 with the following:

1.03 Since the fault isolation chart refers to the board by part name, Table I is provided to correlate part name with part number, color code, and board location.

LOCATION NUMBER	NOMENCLATURE	COMMENTS
615	PC/Usage Boundary	Boundary between peg count and usage. Standard setting is 080 but the boundary may be set for any "ones" input number between 000 and 199.

MODEL 566/SONDS
TRAFFIC RECORDER
INSTRUCTION MANUAL

Printed in U.S.A.

CAUTION

DO NOT CONNECT A "GROUNDED" TEST INSTRUMENT SUCH AS AN OSCILLOSCOPE OR VOLTMETER TO THE "REF" TEST POINT ON ANY PRINTED CIRCUIT CARD IN THIS SYSTEM. SEVERE DAMAGE TO THE SYSTEM WILL RESULT. BEFORE USING SUCH A TEST INSTRUMENT, REMOVE ANY POSSIBLE GROUND CONNECTION, AND OPEN ANY "THIRD WIRE" GROUND CIRCUIT FROM THE AC OUTLET. "REF" TEST POINTS ARE CONNECTED DIRECTLY TO THE NEGATIVE (-) TERMINAL OF THE CENTRAL OFFICE BATTERY.

IMPORTANT: READ BEFORE INSTALLING

F.C.C. REGISTRATION REQUIREMENTS

NOTE: The following F.C.C. registration requirements apply to the Traffic Recorder only for integral modem outputs with direct connection to telco lines.

1. USER'S RESPONSIBILITY

1.01 The User is required to notify the telephone company of the connection or disconnection of the device, the make, model number, FCC registration number and ringer equivalence and the particular line to which it is to be made. If the proper jack(s) are not available, the User must order the type of jack(s) to be used from the telephone company.

Information for this Equipment:

Manufacturer:	Alston Division, Conrac Corporation
Model Number:	80566/SONDS
Registration Number:	AI966P-67963-RT-N
Ringer Equivalence:	0.1
Plugs that may be used:	RJ11C

1.02 It is prohibited to connect this equipment to pay telephone or party lines.

2. TELEPHONE COMPANY RIGHTS AND RESPONSIBILITIES

2.01 Under certain circumstances, the telephone company may discontinue service if the device causes harm to the telephone network. In this case, the telephone company shall:

(a) Promptly notify the customer of discontinuance.

(b) Afford the customer the opportunity to correct the situation which caused discontinuance.

(c) Inform the customer of his rights to bring a compaint to the FCC concerning the discontinuance.

2.02 The telephone company may make changes in its facilities and services which may affect the operation of the User's equipment. However, the User shall be given adequate notice in writing to allow the User to maintain uninterrupted service.

2.03 In case of trouble with this Unit, return the Unit to the Manufacturer for repair, or have the Manufacturer or his Representative repair it in place. Do not attempt to repair the Unit as this will violate the FCC Rules and may cause danger to persons or the telephone network.

Figure 1—Model 566/SONDS Traffic Recorder (With Model 966 Memory Window)

INTRODUCTION

This manual contains installation, operation, and maintenance instructions for the Model 566/SONDS Traffic Recorder manufactured by the Alston Division of Conrac Corporation, Duarte, California. See Figure 1.

The information contained herein is for the use of Traffic Engineers, Planners, Installers, and Maintenance personnel and wherever possible, is arranged in sections which completely discuss the procedures involved without reference to other sections.

SECTION I—provides an overall description of the equipment, electrical specifications, and physical characteristics.

SECTION II—provides installation considerations.

SECTION III—describes operation sequence.

SECTION IV—discusses the overall principles of operation and a detailed description of each printed circuit board.

SECTION V—contains troubleshooting instructions and a Fault Isolation Chart.

SECTION VI—provides a list of replaceable parts.

Schematics, wiring and logic diagrams are available in a separate volume. Qualified PIC centers, maintenance centers, and support groups that have been assigned the responsibility of maintaining this equipment may acquire Volume II by application to:

Customer Service Dept.
Alston Division
Conrac Corporation
1724 South Moutain Avenue
Duarte, California 91010
Telephone (213) 357-2121

TABLE OF CONTENTS

TABLE OF CONTENTS
(Cont'd)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS
(Cont'd)

LIST OF TABLES

SECTION I

DESCRIPTION

Contents Page

1. GENERAL

1.01 The Model 566/SONDS Traffic Recorder, hereafter referred to as the Traffic Recorder, collects traffic and maintenance data from electromechanical telephone exchanges. This unit is designed in accordance with AT & T Technical Advisory No. 30. The Traffic Recorder can be permanently mounted in remote access areas, and used separately to gather peg count and usage data, or it may be used in conjuntion with existing usage scanners. In addition, a Model 966 Memory Window (control unit) may be connected to provide data display and to issue commands. Refer to Table A for specifications of the equipment.

TABLE A
SPECIFICATIONS

POWER REQUIREMENTS	
Voltage:	43 to 72 VDC from exchange battery
Current:	0.5 amps
Fuse:	2.0 amps
PHYSICAL CHARACTERISTICS	
Construction:	Modular all solid-state circuitry on plug-in circuit boards.
Connections:	
Memory Window	9-pin plug, Cinch DE9PA or equivalent.
Local Print and EIA	9-pin socket, Cinch DE-9SA or equivalent.
Line In	Telephone Jack 623K4.
Dimensions	
Height:	8 ¾ inches (22 cm) without optional cable support assembly.
	10 ½ inches (26.7 cm) including optional cable support assembly.
Width:	19 inches (48.3 cm)
Depth:	12 inches (30.5 cm)
Weight:	25 pounds (11.3 kg)
INPUT LEADS	
Capacity:	80 to 1920 leads. First 200 leads are "ones" inputs and the remaining 1720 leads are pre-programmed into "eights" groups. The capacity is expandable in increments of 80 inputs by adding circuit boards (up to 24).
Impedance:	One megohm to ground, minimum.
Protection:	±2000 volts, momentary
Connections:	0.03 X 0.06 wire wrap
Signal Threshold:	Busy: -10V or more positive. Idle: -20V or more negative.

TABLE A
SPECIFICATIONS
(Cont'd)

Signal Duration ("ones" group):	Digital Filter switch-selected to any one of four settings: 20 ms on and 20 ms off 80 ms on and 80 ms off 120 ms on and 40 ms off 40 ms on and 120 ms off
MEMORY	
Register Quantity:	200 TRI registers arranged as active/passive short term and active long term.
Capacity:	65,535 (No overflow)
Mapping:	200 "ones" leads and 1720 "eights" leads maximum.
OUTPUT	
Signal:	Serial EIA port, and pollable port consisting of either an RS232C interface or an Integral Modem (selected at time of order).
Baud Rate:	110, 300, 1200 (selectable)
Mode:	Serial, full duplex.
Code:	ASCII, eight-level, ten bit.
Parity:	Even, odd, none, (selectable.
Format Types:	Traffic data reports and maintenance data reports.
GENERAL	
Office ID:	Three digit (000 to 999) (switch selectable)
Clock:	Integral 24-hour
External Time Pulse Output:	10, 36, 60, or 100-second ground pulse, selectable through the personality map.
ENVIRONMENTAL CONDITIONS	
Operating Temp:	10°C to 40°C
Storage Temp.	-40°C* to 65°C
Operating Humidity:	10% to 90% noncondensing
Storage Humidity:	5% to 95% noncondensing
	*Units taken out of extreme storage temperatures must be allowed to stabilize to within the operating temperatures before operation.

1.02 The Traffic Recorder is completely solid-state for low power consumption and high reliability.

2. FUNCTIONAL DESCRIPTION

TRAFFIC RECORDER

2.01 The Traffic Recorder is a microprocessor-based system with an input study lead capacity of 80 through 1920 leads, incrementable in groups of 80 by adding additional input circuit boards. The maximum capacity is 24 boards. Two hundred of these leads are grouped as "ones" leads and may be preset to develop either peg count or usage. The remaining inputs are grouped as "eights" and are preset to develop usage only. The unit will provide traffic data in either peak or accumulative mode, and will also generate an unusual usage maintenance report to identify "always busy" and "always idle" inputs.

2.02 The memory circuit utilizes 200 "Tri" registers to store short term active, short term passive and long term active data on the input leads being studied. The memory circuit also contains a customer-administered personality map to determine the operating characteristics of the unit, such as the "ones" group boundary, and the "eights" group registers and scan rates. Included in the personality map are assignment registers that can be used to

perform addition and subtraction of short-term PASSIVE registers, the results of which can be assigned as a group to a particular short-term passive output register. The personality map is stored in nonvolital PROM (Programmable Read Only Memory) and is written into the volatile read/write memory whenever the system is powered up. The parameters of the map may be changed by inputting new data through the polling port or with the use of the Memory Window, however, these changes must be reentered each time the system is powered up. Details of the personality map are discussed in Section III concerning the operation of the Traffic Recorder.

2.03 The Traffic Recorder may be polled from a central location by utilizing an Alston ATEMIS computer system or a Model 822 Poller. The output of the Traffic Recorder is equipped with a three-wire (send, receive, command) serial EIA port for optional connection to a local printer. The Traffic Recorder is also equipped with a pollable port consisting of either an integral low-speed, answer-only modem (switch network or private line), or an RS232C interface to which an external modem may be connected. The integral modem and the RS232C interface are mutually exclusive and selection was determined at time of order. For the integral modem type output, with direct connection to telco lines, refer to F.C.C. regulations in the front of this manual.

2.04 An integral 24-hour clock is incorporated into the Traffic Recorder circuitry synchronized to AC power line (50 or 60 Hz). The free-run accuracy of the clock is ± 90 seconds per week.

MEMORY WINDOW (MODEL 966)

2.05 The Model 966 Memory Window (Control Unit) can be connected to the front panel of the Traffic Recorder to permit the clock time, memory lead contents, and the status and personality map contents of the individual leads, to be viewed on an eight-digit LED readout. The control unit also provides a 16-button keypad that can be used to issue polling commands to the Traffic Recorder on location. The operation of the Control Unit is discussed in detail in Section IV.

3. PHYSICAL DESCRIPTION

3.01 The Traffic Recorder consists of a rigid chassis with sheet metal covers and a plastic rear cover. The sides are fitted with mounting brackets. The unit is designed to mount in a standard 19-inch telephone type rack. The unit may also be installed in a 23-inch rack by replacement of the left mounting bracket. The vertical mounting space requirement is 8 ¾ inches (22.2 cm) without using optional cable support assembly, 10 ½ inches (26.7 cm) including support assembly, and 12 ¼ with support assembly installed and input leads fully configured. With the exception of the Memory Window connector located on the front panel, all other connections to the Traffic Recorder are made at the rear of the chassis. See Figure I-1.

3.02 All of the circuitry of the equipment is mounted on circuit boards that slide into slots in the card cage built into the unit. The unit consists of a 33 position card cage chassis. When a circuit board is completely inserted into the card cage, the pins on the leading edge of the board make contact with jacks mounted in the card cage. An ejector is mounted on the front of each circuit board, color coded to indicate the type of circuit board. An exception to this is the Interconnect Board, which is mounted parallel to the rear cover for external power and output connections, and the Daughter Board mounted on the Control board. Easy access to the slide-in circuit boards is obtained by removing four screws securing the front panel. See Figure I-2 for card cage configuration.

3.03 Cables furnished with the equipment consist of a 20-foot interconnecting cable assembly supplied with the Memory Window, and a single 15-foot line furnished with the Traffic Recorder for connecting the clock sync to an AC power line.

4. ABBREVIATIONS AND TERMS

4.01 A listing of abbreviations and terms used in this manual are provided in Appendix A.

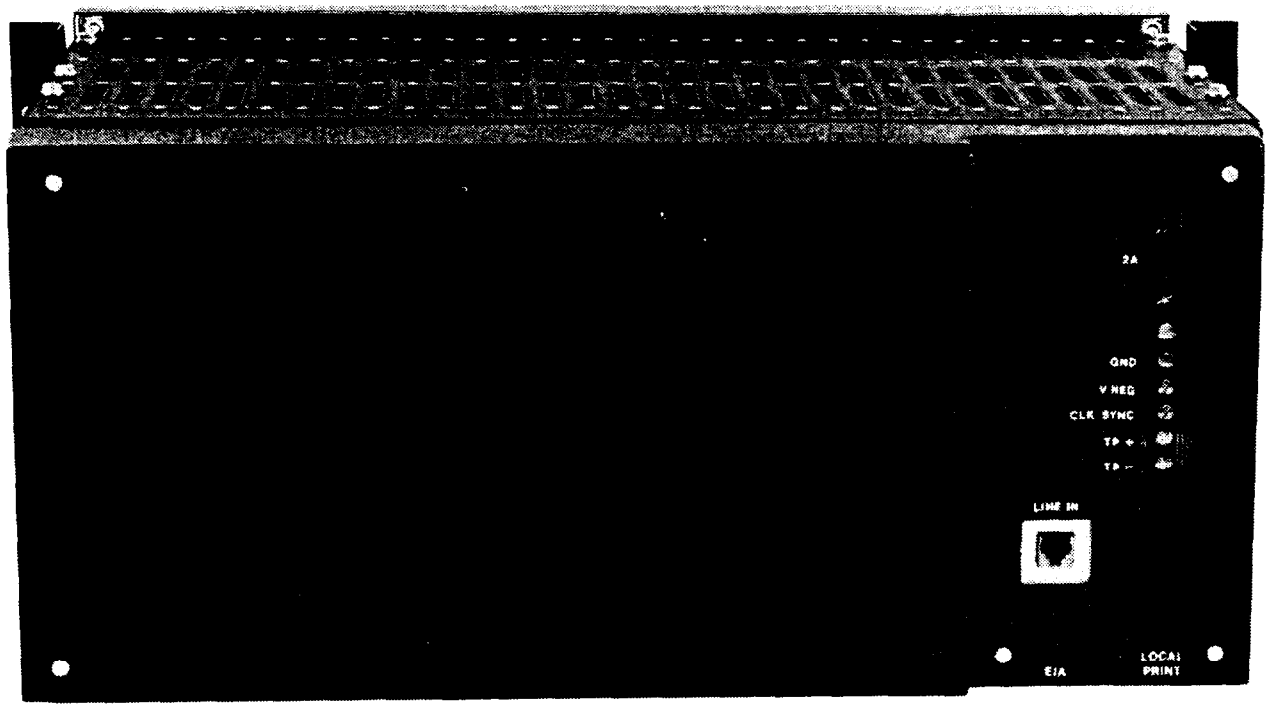


Figure I-1—Traffic Recorder, Rear Panel

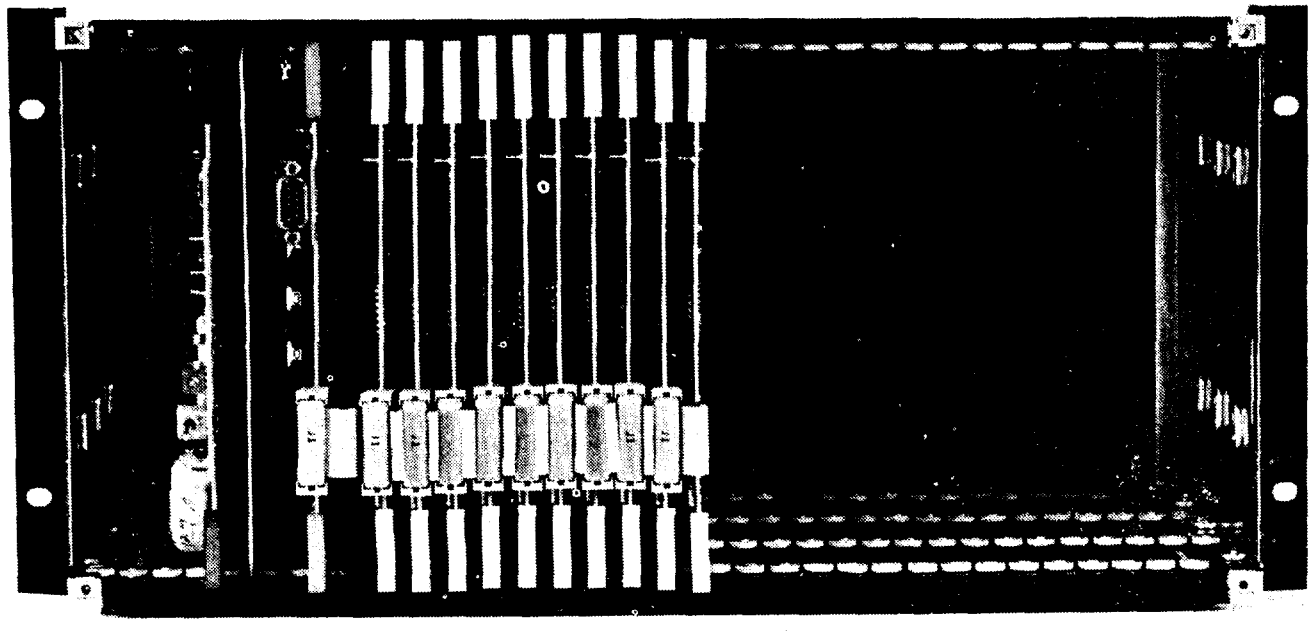


Figure I-2—Traffic Recorder, Front Panel Removed

SECTION II

INSTALLATION

Contents Page

1. GENERAL

1.01 This section provides unpacking, initial inspection, and mechanical and electrical installation instructions for the Traffic Recorder.

2. INITIAL INSPECTION AND CHECKOUT

UNPACKING

2.01 The Traffic Recorder is shipped in a cardboard container which bears the model and serial number of the unit. It is packed in molded plastic foam to prevent it from moving inside the box during shipment. Vinyl sheeting isolates the equipment from the foam.

2.02 When the box is opened, pull the top piece of molded foam straight up and out to expose the equipment. (A second section of foam is secured to the bottom of the box.) Lift the unit straight up and out, together with all accessories. The Memory Window is shipped in a separate container. Check each item against the enclosed packing list to verify that all parts are present. Contact Alston Customer Service if items are not in agreement with the packing list. If possible, the box and foam should be saved for future shipment of the equipment.

2.03 Immediately after unpacking, visually examine the equipment for signs of transport damage. If damage is detected, contact the local representative of the responsible common carrier.

3. MECHANICAL INSTALLATION

3.01 The Traffic Recorder is designed for a fixed rack installation in any standard 19-inch equipment rack. The holes in the mounting brackets on the sides of the unit align with the holes in the equipment rack, and the entire unit is bolted to the rack using four screws (screws are provided). No additional support is required. See Figure II-1. The unit may also be adapted to a 23-inch equipment rack by replacement of the left mounting bracket, as viewed from the front of the frame, with a 23-inch mounting bracket (209675).

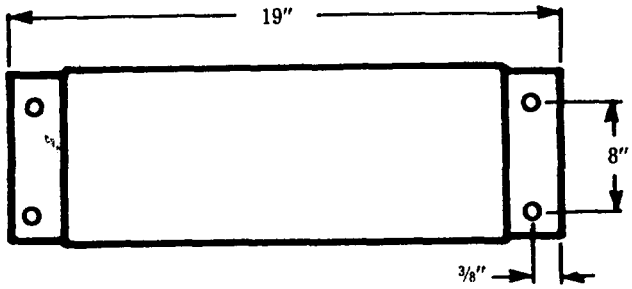


Figure II-1—Installation Dimensions

3.02 The position of the Traffic Recorder's front panel relative to the rack mounting plane may be adjusted in one inch increments. There are three sets of threaded holes spaced 2 inches apart on each side of the unit. The mounting brackets can be installed in any one of these sets of holes. One inch adjustment is obtained by turning the mounting brackets end for end and securing them in the same set of holes. See Figure II-2.

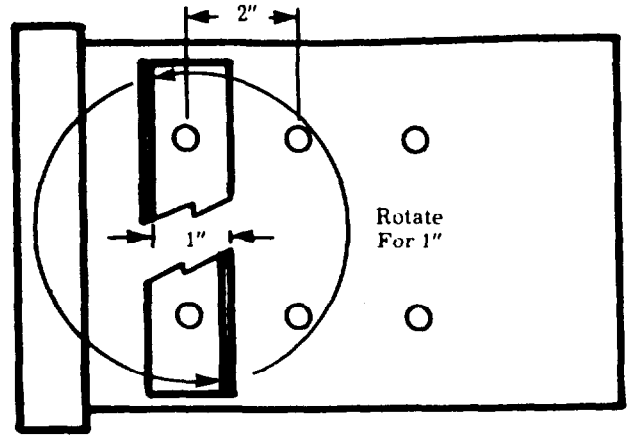


Figure II-2—Bracket Adjustment Diagram

USE OF CABLE SUPPORT ASSEMBLY (FIGURE II-3)

3.03 If the number of input lines being connected is limited to one or two Input Circuit Boards, the cable support assembly generally is not required and the vertical mounting space requirement for the unit is only 8 ¾ inches (22.2 cm). When the cable support assembly is used, and the number of input lines being connected does not exceed 960, cable lays can remain above the support assembly and the vertical mounting space requirement will be 10 ½ inches (26.7 cm). When the cable support assembly is used, and the number of input lines being connected is between 960 and 1920, cable lays must be routed on both sides of the support assembly and the vertical mounting space requirement becomes 12 ¼ inches (31.1 cm).

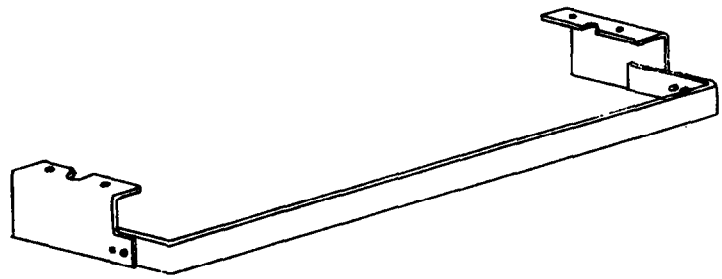


Figure II-3—Cable Support Assembly

4. ELECTRICAL INSTALLATION

4.01 All electrical connections to the Traffic Recorder are made through cable connectors, wire wrap terminals, or screw terminals at the rear panel. See Figure II-4. Typical interface connections are shown in Figure II-5. The Memory Window (Model 966), when used with the Traffic Recorder, is connected through the cable connector on the front panel. See Table B.

POWER CONNECTIONS

4.02 Power is supplied to the unit from the -48V office battery source and is connected to the screw terminals marked V NEG and GND on the rear of the unit.

CAUTION: Battery and ground wiring must be 18 AWG or larger to insure proper operation of the system.

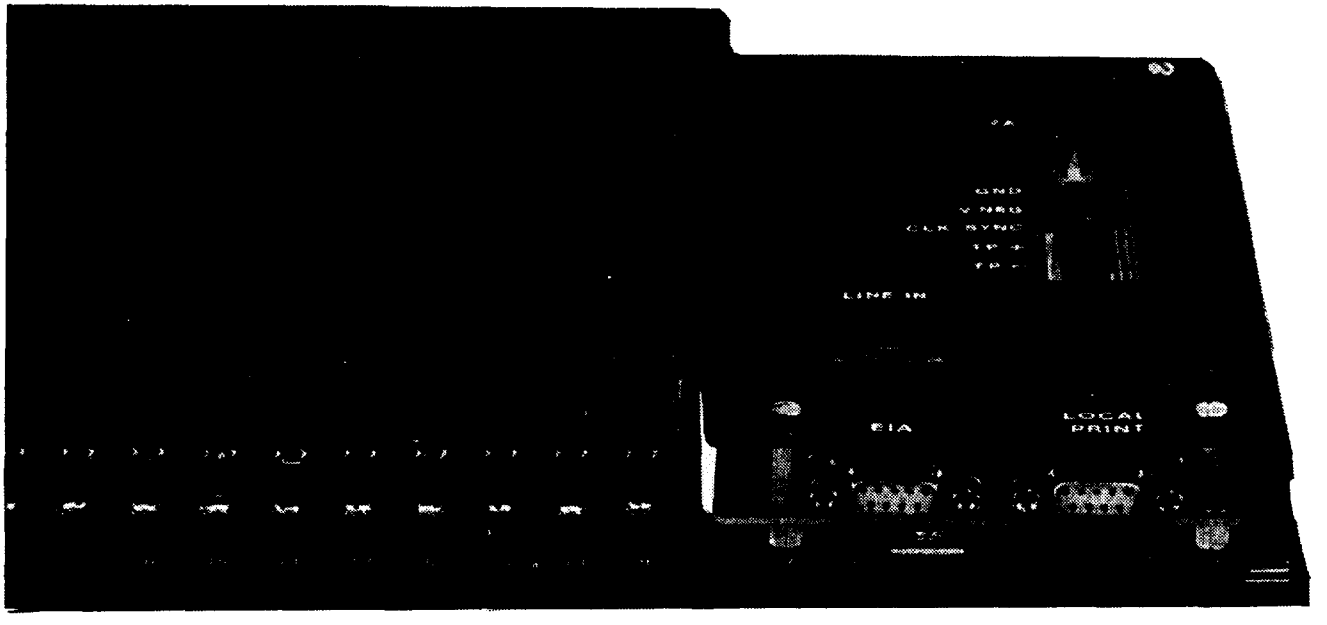


Figure II-4—Traffic Recorder Rear Panel Connections

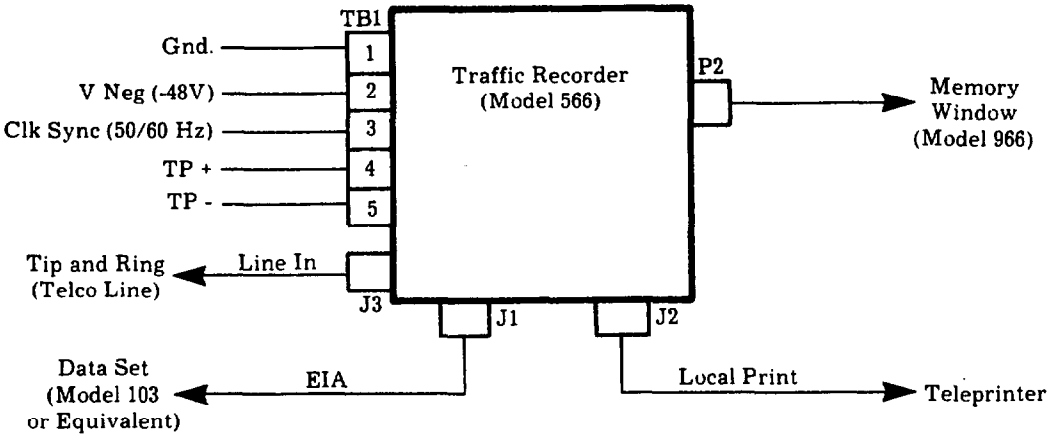


Figure II-5—Equipment Interface Diagram

TABLE B
MEMORY WINDOW CONNECTOR
PIN DESIGNATIONS

Pin No.	Designation
1	Ground
2	-12 VDC
3	+12 VDC
4	(No Connection)
5	+5 VDC
6	Ground
7	Received Data
8	Transmitted Data
9	+5 VDC

INPUT/OUTPUT CONNECTIONS

4.03 There are three input/output connectors on the rear panel of the unit. Two of these are DB9 socket connectors, and the other is a type 623K4 telephone connector. See Table C.

CLOCK SYNC CONNECTION

4.04 The clock sync, used to reference system timing to 110 VAC power, is a single wire with a special wall plug that is furnished with the Traffic Recorder. It is connected to the screw terminal marked CLK SYNC on the rear of the unit.

INPUT LEAD CONNECTIONS

4.05 All input lead connections are made to the rear panel input terminal field as shown in Figure II-6. Each terminal field is numbered from top to bottom, with input number 0000 corresponding to the first wire, input number 0040 corresponding to the forty-first wire, etc. Input wiring should be 24 AWG twisted pair (standard switchboard cable) and should be formed down the left side of the unit as looking from the rear of the frame. Access to the terminal field is obtained by removing the rear cover.

TABLE C
INPUT/OUTPUT CONNECTOR PIN
DESIGNATIONS

Pin No.	Function
LOCAL PRINT CONNECTOR (J1)	
1	(No Connection)
2	Print Transmitted Data
3	Print Received Data
4	(No Connection)
5	(No Connection)
6	(No Connection)
7	Ground
8	(No Connection)
9	(No Connection)
EIA CONNECTOR (J2)	
1	Ring Indicator
2	Transmitted Data
3	Received Data
4	Request to Send
5	Clear to Send
6	Data Set Ready
7	Ground
8	Data Terminal Ready
9	Data Carrier Detect
LINE IN CONNECTOR (J3)	
GRN	Tip
RED	Ring
BLK	(No Connection)
YEL	(No Connection)

A. Cabling and Wiring.

4.06 Cabling and wiring should be protected against abrasion and should not be routed over sharp edges, screws, or other details that may cause abrasion or penetration of insulation.

Cabling and wiring should not be bent any sharper than one wire diameter for individual wires, or five diameters for cables and harnesses.

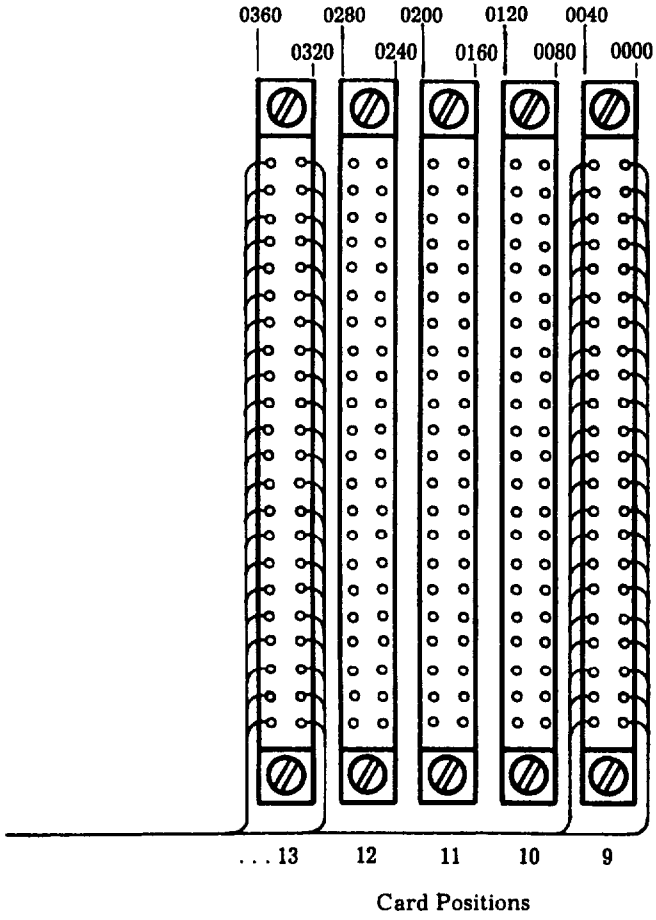


Figure II-6—Typical Input Lead Routing

B. Wire-Wrap Connections

4.07 The minimum number of uninsulated wraps should be five wraps for #24 AWG wire. The insulation should be stripped from the end of the wire without damaging the conductor and without damaging the insulation remaining on the wire. The insulation should not be displaced greater than 0.04 inches (1 mm) from the wrap post terminal. There should be no gaps between adjacent wrap turns greater than one-half a wire diameter, exclusive of the first and last turn of any wrap, or overlapping of wrap turns within the minimum required number of turns of uninsulated wire. The wire routing direction should be in accordance with Figure II-7. In general, the cable will be easier to route and arrange by first connecting input wires to the bottom of the terminal field, beginning with input numbers 0039 and 0079, and working upward toward the top of the terminal field.

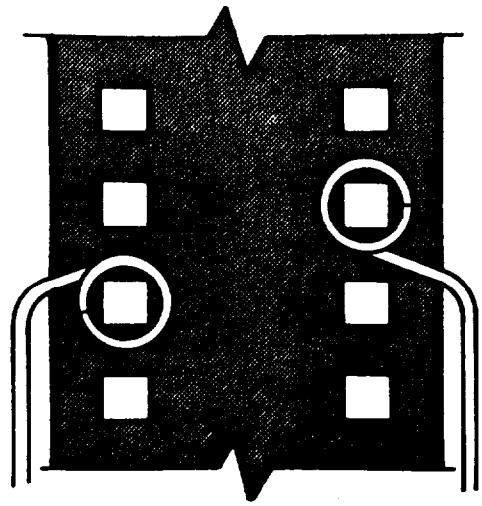


Figure II-7—Typical Terminal Wire Wrap

4.08 Figure II-8 illustrates the recommended configuration for electrical installation of the Traffic Recorder, and includes considerations for the installation of more than one unit.

SWITCH SETTINGS

4.09 The following switch settings are made when the equipment is first installed. These switches are all located on either the Modem/Power Supply Board or the Control Board as shown in Figure II-9 and Figure II-10. No circuit adjustments are required.

A. Selection of Operating Frequency

4.10 SW1 on the Modem/Power Supply Board selects operating frequency (U.S. or CCITT Standard). Under normal operating conditions, the U.S. standard frequency is used. SW1 should be set with switch 1 OFF and switches 2, 3, and 4 ON.

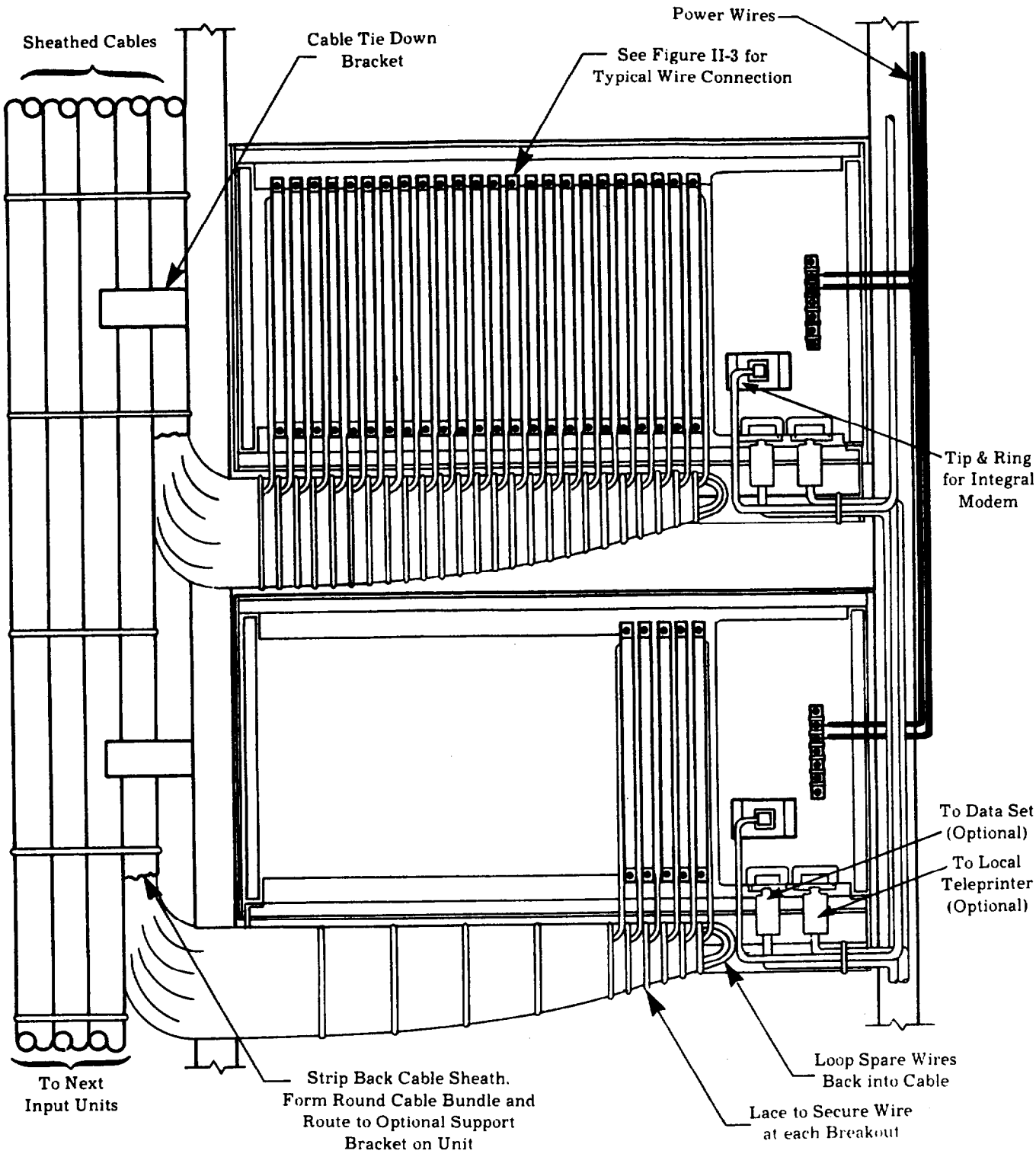


Figure II-8—Electrical Installation

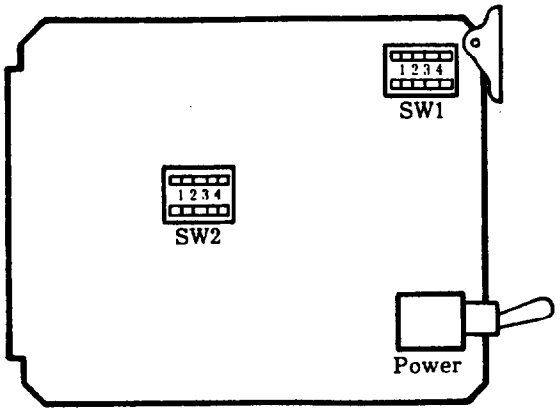


Figure II-9—Switches on the Modem/Power Supply Board

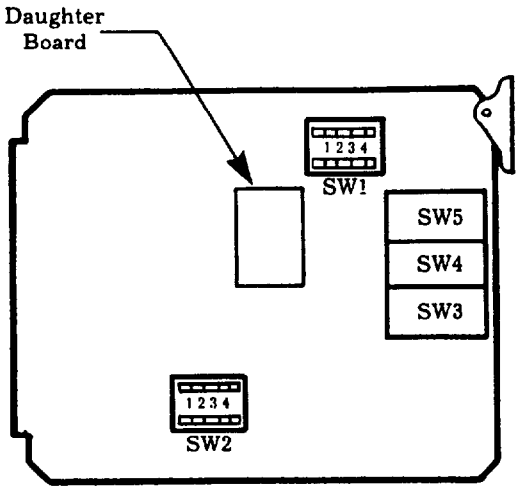


Figure II-10—Switches on the Control Board

B. Selection of Answer/Originate

4.11 SW2 on the Modem/Power Supply Board is used to select the answer/originate option. This option is not used with a customer-furnished data set. SW2 should be set with all four switches OFF.

C. Selection of Baud Rate and Parity

4.12 SW1 on the Control board is used to select the baud rate (110, 300 or 1200) and the parity (even, odd, or no parity). Table D lists the switch settings for SW1.

TABLE D
CONTROL BOARD SWITCH SETTINGS

Option	Switch Positions* 1	2	3	4
SW1				
110 Baud	0	0	X	X
300 Baud	0	1	X	X
1200 Baud	1	1	X	X
Even Parity	X	X	1	1
Odd Parity	X	X	0	1
No Parity	X	X	0	0
SW2				
20 ms ON/20 ms OFF	X	1	1	X
80 ms ON/80 ms OFF	X	1	0	X
120 ms ON/40 ms OFF	X	0	0	X
40 ms ON/120 ms OFF	X	0	1	X

*0 = OFF, 1 = ON, and X indicates that switch is not used to select option

D. Selection of Digital Filter Response Time

4.13 SW2 on the Control Board is used to select the digital filter response times. Refer to Table D for proper settings.

E. Selection of Office Identification

4.14 The three-digit office identification number is selected on the three ten-position thumbwheel switches (SW3, SW4, and SW5) located on the Control Board.

CIRCUIT BOARD REMOVAL AND INSTALLATION

4.15 The Modem/Power Supply Board (385246), red ejector, is installed in card position 4, the Control Board (385247), blue ejector, is installed in card position 7, and the Input Boards (385240), white ejectors, are installed in card positions 9 through 32.

4.16 The Control Board has two edge connectors on the front, it also contains the Daughter Board to provide the PROMs containing the system's program. The control board is designed for easy removal and replacement for program modification and updating. The top edge connector on the Control Board is for use with the optional Memory Window (Model 966) and the bottom connector provides signaling to the Input Boards.

4.17 Each Input Board is equipped with a short ribbon cable having an edge connector and a plug on the end. The plug on each ribbon cable is connected to the edge connector of the previous board so that all Input Boards installed in the card cage will be connected in cascade fashion.

SECTION III

OPERATION AND CHECKOUT

Contents Page

1. GENERAL

1.01 This section contains operation and checkout instructions for the Traffic Recorder (Model 566). The instructions provide system checks, to be performed prior to operation, that will verify that all major features of the unit are operational. In addition, paragraphs and tables are included to properly define the operating functions of the system.

1.02 Self-Test capabilities are built into the system software to test memory and inputs. To use these capabilities, a local teleprinter can be connected to the LOCAL PRINT port, or by use of the appropriate modem, self-test, along with system operation, may be made through the EIA or telephone port. Operation and checkout can also be accomplished using the optional Memory Window (Model 966) for which instructions are provided in this section.

NOTE: Before performing self-test or operating the system, ensure that all circuit switches have been properly set. Refer to SWITCH SETTINGS (Section II).

2. SELF TEST

2.01 The following paragraphs outline the self-test functions that should be verified prior to system operation. The self- test functions may be verified with a teleprinter connected to the LOCAL PRINT port or with the appropriate

modem, through the telephone line to either the EIA or telephone port. The self-test functions may also be verified using a Model 966 Memory Window as described in sub-section 10 of this section.

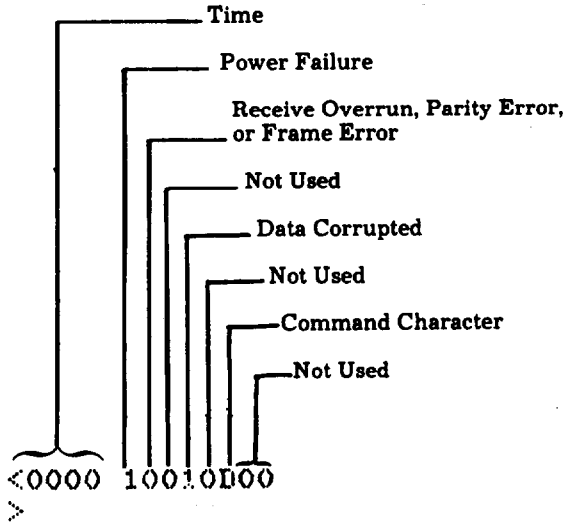
2.02 In order to perform both self-test and operation, it is usually desireable to first verify the contents of the personality map. By entering the command C4E, the personality map, discussed in sub-section 5, will be printed out and may be verified against the desired map. This action also assures that the UART (Universal Asynchronous Receiver Transmitter) and most other internal functions of the processor circuitry are operational.

CAUTION: The execution of self test commands will cause the loss of any alterations made to the personality map by the user. All self tests should be completed before making any alterations to the personality map.

INPUT TEST, ROM TEST, AND RAM TEST

2.03 When the personality map has been verified, the input test, ROM test, and RAM test can be performed. All three tests are performed by the use of a single command. Proceed as follows:

(a) Enter the command D ↑ Q to initiate the test. The following report should be printed out:




```
INPUT TEST PASS
CRC'S 5A24 F26D 726F
RAM TEST PASS
```

(b) If a failure occurs in the input test, the printout will indicate the words, INPUT TEST FAIL, followed by the card (board) number and input lead number where the first failure occurred. When a failure occurs, insure that connectors are firmly in place and repeat the test.

(c) The ROM test reports the CRC's (Cyclic Redundancy Checks) which consists of three, four-digit hexadecimal numbers. Compare the numbers in the actual printout for proper match with those appearing on the ROM chips mounted on the Daughter Board. The numbers in the above printout are only given as an example.

(d) If a failure occurs in the RAM test, the printout reports the first RAM address where an error was detected. The printout for a RAM test failure should be similar to the following:

```
RAM TEST FAIL

ADDRESS    WAS    SHOULD BE
  2423      4A        4B
```

3. READ/WRITE MEMORY

3.01 The read/write memory is divided into a personality map that directs incoming data to the proper register, and two hundred "Tri registers" that are used for storage of the lead study data. For proper operation of the system, an understanding of the memory register and personality map is necessary.

4. REGISTER MODES

4.01 The "Tri" registers consist of memory storage for short term active, short term passive and long term active data. The following paragraphs describe how these registers are used. See Figure III-1.

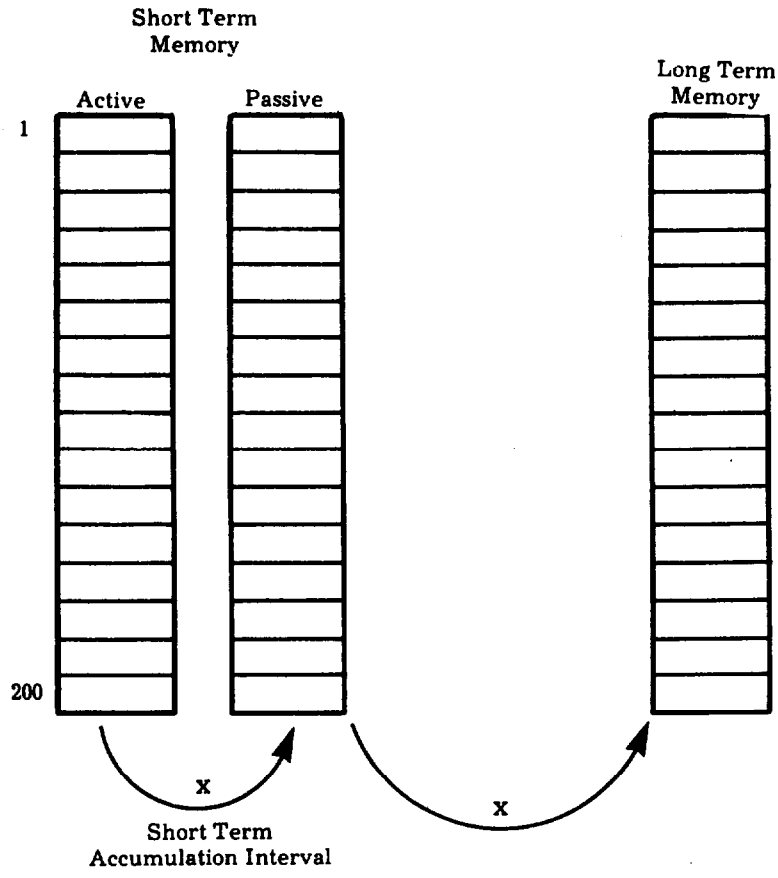


Figure III-1—Memory Organization

SHORT TERM REGISTERS

4.02 The short term active memory accumulates all the active data since the last buffer transfer, up to the present time.

4.03 At the end of each short-term memory accumulate interval (x), the contents of the short-term active memory are transferred to the short term passive memory. At this time the addition and subtraction registers are also calculated.

LONG TERM REGISTERS

A. Accumulate Until Reset Mode

4.04 At the end of each short-term memory accumulate interval (x), the contents of the short-term passive memory are added to the contents of the long-term memory. When a remote clear command is received, the long-term memory is set to zero.

B. Peak Until Reset Mode

4.05 At the end of each short-term memory accumulate interval, the contents of each short-term passive register is compared with the corresponding long-term active register and the higher of the two values is retained in the long-term active register. When a remote reset command is received, the long-term active memory is set to zero.

5. PERSONALITY MAP

5.01 A typical personality map is shown in Figure III-2. This map is a section of read/write memory, 790 bytes long, that has been transferred from program storage at power up. The first column to the left of the asterisk (*) is printed to give the first map location on each line.

The personality map may be output by entering the command C4E to the Traffic Recorder.

5.02 The first two hundred locations in the map are used to specify the memory mode of the output registers. 000 corresponds to the accumulate daily mode, 001 to the peak daily mode and 002 is the accumulate until reset mode. Any register may be set to any mode, but the standard groupings are as shown in Figure III-2.

5.03 The next two hundred locations in the map (200 through 399) are used to direct "ones" input leads to a particular register. Any input may be assigned to any register in this group. In this particular case, the first eighty are the only inputs assigned. The remaining registers are not programmed as denoted by the number 255 appearing in all other locations in the group.

5.04 The next two hundred and fifteen locations (400 through 614) are used to direct "eights" input groups to a particular register. Of these, the first one hundred and twenty are assigned, as shown by the numbers 080 through 199, and the remainder of the "eights" input group is not programmed, as again denoted by the number 255 appearing in the locations for all unused registers. Any input group may be assigned to any register.

5.05 The remaining fifteen locations in the map are used as follows:

(a) Location 615 specifies the boundary between peg count and usage for the "ones" inputs. This boundary may be set to any "ones" input number that is evenly divisible by four. All numbers below the boundary will be peg count, and all numbers beginning with the boundary number and above will be used for usage. The standard setting is 80.

(b) Location 616 defines the "ones" input scan rate for usage data. This register may be set for 1, 3.6, 6 or 10 second scan rates. The actual number appearing will correspond to tenths of seconds and will be 010, 036, 060, or 100 respectively. The standard setting is 1 second (010)

(c) Location 617 defines the A/B scan rates boundary. This boundary is a board number. All boards below this number will be scanned at a rate determined by A, and all boards above this number will be scanned at the B scan rate. The readout will be between 003 and 024.

(d) Locations 618 and 619 contain the A and B scan rates respectively. The actual numbers indicate seconds and may be set to 010, 036, 060, or 100. The standard setting for B scan rate (619) is 100 seconds.

(e) Location 620 contains the time pulse rate. This is a transistorized switch connected to TB1, and it provides a ground-pulse output at the rate of 10, 36, 60 or 100 seconds. Standard setting is 100 seconds.

(f) Location 621 contains the short term interval. This is a time period for transfer of data between the short-term active and short-term passive memories, and may be set to 15, 30, or 60 minutes. Standard setting is 60 minutes.

(g) Location 622 contains the short-term register size and location 623 contains the long-term register size. Both may be set for four or five digits. A setting of four digits suppresses the most significant digit. Standard settings are 004 for location 622, and 005 for location 623.

(h) Location 624 indicates the line frequency of either 50 or 60 Hz.

(i) Location 625 indicates the last register to output. In the case of Figure III-2, the last register output was 199.

(j) Location 626 is the long space readout and may be set to 000 for a register read-out of active short-term, 001 for passive short-term, 002 for active long-term, or 003 for passive long-term.

(k) Location 627 is the short auto print and 628 is the long auto print. These are disabled with a zero (000) and enabled with a one (001). When enabled at the end of a memory time interval, the contents of the passive registers are output through the I/O port.

PERSONALITY MAP

```
000*000 000 000 000 000 000 000 000 000 000
010*000 000 000 000 000 000 000 000 000 000
020*000 000 000 000 000 000 000 000 000 000
030*000 000 000 000 000 000 000 000 000 000
040*000 000 000 000 000 000 000 000 000 000
050*001 001 001 001 001 001 001 001 001 001
060*001 001 001 001 001 001 001 001 001 001
070*001 001 001 001 001 001 001 001 001 001
080*001 001 001 001 001 001 001 001 001 001
090*001 001 001 001 001 001 001 001 001 001
100*002 002 002 002 002 002 002 002 002 002
110*002 002 002 002 002 002 002 002 002 002
120*002 002 002 002 002 002 002 002 002 002
130*002 002 002 002 002 002 002 002 002 002
140*002 002 002 002 002 002 002 002 002 002
150*003 003 003 003 003 003 003 003 003 003
160*003 003 003 003 003 003 003 003 003 003
170*003 003 003 003 003 003 003 003 003 003
180*003 003 003 003 003 003 003 003 003 003
190*003 003 003 003 003 003 003 003 003 003
200*000 001 002 003 004 005 006 007 008 009
210*010 011 012 013 014 015 016 017 018 019
220*020 021 022 023 024 025 026 027 028 029
230*030 031 032 033 034 035 036 037 038 039
240*040 041 042 043 044 045 046 047 048 049
250*050 051 052 053 054 055 056 057 058 059
260*060 061 062 063 064 065 066 067 068 069
270*070 071 072 073 074 075 076 077 078 079
280*255 255 255 255 255 255 255 255 255 255
290*255 255 255 255 255 255 255 255 255 255
300*255 255 255 255 255 255 255 255 255 255
310*255 255 255 255 255 255 255 255 255 255
320*255 255 255 255 255 255 255 255 255 255
330*255 255 255 255 255 255 255 255 255 255
340*255 255 255 255 255 255 255 255 255 255
350*255 255 255 255 255 255 255 255 255 255
360*255 255 255 255 255 255 255 255 255 255
370*255 255 255 255 255 255 255 255 255 255
380*255 255 255 255 255 255 255 255 255 255
390*255 255 255 255 255 255 255 255 255 255
400*080 081 082 083 084 085 086 087 088 089
410*090 091 092 093 094 095 096 097 098 099
420*100 101 102 103 104 105 106 107 108 109
430*110 111 112 113 114 115 116 117 118 119
440*120 121 122 123 124 125 126 127 128 129
450*130 131 132 133 134 135 136 137 138 139
460*140 141 142 143 144 145 146 147 148 149
470*150 151 152 153 154 155 156 157 158 159
480*160 161 162 163 164 165 166 167 168 169
490*170 171 172 173 174 175 176 177 178 179
500*180 181 182 183 184 185 186 187 188 189
510*190 191 192 193 194 195 196 197 198 199
520*255 255 255 255 255 255 255 255 255 255
530*255 255 255 255 255 255 255 255 255 255
540*255 255 255 255 255 255 255 255 255 255
550*255 255 255 255 255 255 255 255 255 255
560*255 255 255 255 255 255 255 255 255 255
570*255 255 255 255 255 255 255 255 255 255
580*255 255 255 255 255 255 255 255 255 255
590*255 255 255 255 255 255 255 255 255 255
600*255 255 255 255 255 255 255 255 255 255
610*255 255 255 255 255 080 010 025 010 100
620*100 060 004 005 060 199 001 001 001 004
630*050 051 052 053 054 055 056 057 058 059
640*255 255 255 255 255 255 255 255 255 255
650*255 255 255 255 255 255 255 255 255 255
660*255 255 255 255 255 255 255 255 255 255
670*255 255 255 255 255 255 255 255 255 255
680*255 255 255 255 255 255 255 255 255 255
690*255 255 255 255 255 255 255 255 255 255
700*255 255 255 255 255 255 255 255 255 255
710*255 255 255 255 255 255 255 255 255 255
720*255 255 255 255 255 255 255 255 255 255
730*255 255 255 255 255 255 255 255 255 255
740*060 255 255 255 255 061 255 255 255 255
750*062 255 255 255 255 063 255 255 255 255
760*064 255 255 255 255 065 255 255 255 255
770*066 255 255 255 255 067 255 255 255 255
780*068 255 255 255 255 069 255 255 255 255
790*001
```

Output Register Mode (Location 000 to 199)

"Ones" Input Registers (Location 200 to 399)

"Eights" Input Group Registers (Location 400 to 614)

Miscellaneous Locations (615 to 629) See Table E

Addition Direction Locations (630 to 639)

Addition Register Locations (640 to 739)

Subtraction Register Locations (740 to 789)

Number of Input Boards (790)

Figure III-2—Typical Personality Map

(l) Location 629 is a multiplier for the digital filter response times as listed in Table D of Section II. The multiplier may be set to 001, 002, 003, or 004. For example, if SW2 on the control board had been set to produce a response time of 20 msec ON/20 msec OFF, and location 629 is set for a multiplication rate of 004, the actual digital filter response time would be 80 msec ON/80 msec OFF. Lower multiplication rates improve output resolution.

(m) Location 630 through 639 direct the 10 addition registers to specific output registers. Location 630 is used to direct addition register zero (the sum of the output registers appearing in location 640 through 649), location 631 is used to direct addition register one (the sum of the output registers appearing in location 650 through 659), etc. Unused addition registers are denoted by the number 255 appearing in the corresponsing addition direction location.

(n) Location 640 through 739 contain a total of 10 addition registers that indicate which output registers are to be added. Each of the addition registers may contain up to 10 output registers to be added, the sum of which will appear on the output register specified in the corresponding addition direction location(630 through 639). All unassigned portions of an addition register should be denoted by the number 255.

(o) Locations 740 through 789 contain subtraction registers. There are 10 groups of subtraction registers, each using five locations in the map. The first location in each group assigns the corresponding subtraction registers to a specific output register. The remaining four locations in each group specify the actual output registers (R1, R2, R3, and R4) to be subtracted. Location 740 is used to direct the subtraction performed for the output registers specified in locations 741

TABLE E
SUMMARY OF PERSONALITY MAP ASSIGNMENTS

Location Number	Nomenclature	Comments
000-199	Output Register Mode*	Set to: 000 or 002 for accumulate until reset. 001 or 003 for peak until reset.
200-399	"Ones" Input Map	Assigns "ones" inputs to registers.
400-614	"Eight" Group Input Map	Assigns "eights" group inputs to registers.
615	PC/Usage Boundary	Boundary between peg count and usage. Standard setting is 080 but the boundary may be set for any "ones" input number between 000 and 199 that can be divided by four.
616	"Ones" Scan Rate	Choices are 1, 3.6, 6, and 10 seconds expressed in tenths of seconds. Standard setting is 1 second (010).
617	A/B Scan Boundary	Between 003 and 024.
618	A Scan Rate	010, 036, 060, or 100 seconds (standard setting is 010).
619	B Scan Rate	010, 036, 060, or 100 seconds (standard setting is 100).
620	Time Pulse Rate	010, 036, 060, or 100 seconds (standard setting is 100).
621	Short-term Interval	015, 030, 060 minutes (standard setting is 060).
622	Short-term Register Size	004 or 005 digits.
623	Long-term Register Size	004 or 005 digits.

TABLE E
SUMMARY OF PERSONALITY MAP ASSIGNMENTS
(Cont'd)

Location Number	Nomenclature	Comments
624	Line Frequency	050 or 060 Hz.
625	Last Register to Output	000-199 (standard setting is 199).
626	Long Space Readout	Set to: 000 for active short-term. 001 for passive short-term. 002 for active long-term.
627	Short-term Auto Print	000 or 001 (001 = enabled)
628	Long-term Auto Print	000 or 001 (001 = enabled)
629	Response Time Multiplier	001, 002, 003, or 004.
630-639	Addition Direction Locations	Assigns addition registers to output registers.
640-739	Addition Register Locations	Assigns output registers to be added.
740-789	Subtraction Register Locations	Ten groups of registers, each using five locations in the map. The first location of each group assigns subtraction register to an output register. The remaining four locations in each group specify output registers (R_1, R_2, R_3, and R_4) to be subtracted. The subtraction is performed as follows: $([R_1 + R_2] - [R_3 + R_4])$
790	Input Boards	Specifies quantity of boards installed (001-024)
*Any register may be set to any mode.		

through 744, location 745 is used to direct the subtraction performed for the output registers specified in locations 746 through 749, etc. The subtraction within the register group is performed as follows:

$$(R_1 + R_2) - (R_3 + R_4)$$

(p) Register 790 corresponds to the number of input boards installed (001 to 024).

5.06 Table E provides a summary of register assignments for the personality map shown in Figure III-2.

6. ALTERATIONS TO PERSONALITY MAP

6.01 The following step-by-step procedure should be used for entering alterations into the personality map:

Step 1: Use Control ↟R to transfer from command mode to entry mode.

Step 2: Enter the number of the map location for which an alteration is required. This is done by first entering the hundreds number, then the tens number, and finally, the units number of that location. This entry may be any number between 000 and 629.

Step 3: Use asterisk (*) to transfer program so that actual alteration can be entered.

Step 4: Enter the new data. This is done by entering hundreds in the first digit, tens in the second digit, and units in the third digit. Entry must be three digits. If any error is made during entry, terminate entry with a Control ↟S, then use a Control ↟R to return to entry mode, and repeat entry.

Step 5: Use Space (SP) if new data are

going to also be programmed into next successive location, and then enter a three-digit alteration as before. When next successive location is on the following line of the personality map, use Carriage Return (CR) and Line Feed (LF) rather than Space (SP). If additional alterations are going to be made, but not into the next successive location, repeat Steps 2 and 3 above. This will automatically move the memory to the next desired location.

Step 6: After all alterations have been entered, use Control ↑S to transfer from entry mode to command mode.

TABLE F
POLLING COMMANDS FOR THE TRAFFIC RECORDER

Command	Function
1 2 3 4 5 6 7 [S][↑Q][Hr][Hr][Min][Min] or [C][6][Hr][Hr][Min][Min][E]	Sets clock to the hour and minute indicated in the command.
[T][↑Q] or [C][1][1][E]	Buffer transfer, short-term memory.
[Z][↑Q]	Zero output registers.
[C][↑Q]	Clear status register.
[W][↑Q] or [C][2][0][E]	Print short-term active memory
[H][↑Q] or [C][2][1][E]	Print short-term passive memory.
[R][↑Q] or [C][2][2][E]	Print long-term active memory.
[D][↑Q]	Self-test (Input, ROM, and RAM).
[C][3][1][E]	Initiate AI study.
[C][3][2][E]	Initiate AB study.
[C][3][3][E]	Print AI/AB report.
[A][↑Q] or [C][3][0][E]	Abort printout.

7. POLLING COMMANDS

7.01 All polling commands to the Traffic Recorder are made in the same manner as when requesting a printout of the current personality map, or when performing the self-test functions. The polling commands are presented in Table F. The SONDS commands are followed by alternate commands that may also be used for the same function. For the buffer transfer command T Q (C11E), the active data overwrites; and the passive and active data is cleared. The data are processed into long-term memory.

8. TRAFFIC REPORTS

8.01 Traffic reports are used to determine the amount of traffic going through a particular office. They are automatically generated at the time intervals specified in the personality map. Three types of traffic reports are available as determined by the long term register mode. Both the model selection and the input groupings of each mode become a matter of customer requirement. After the system is installed and powered up, traffic data is continuously gathered until a buffer transfer is initiated by the command listed in Table F. A new traffic report is initiated when the unit is polled. Traffic report printouts are made available by any one of the three print commands listed in Table F. Figure III-3 is a typical traffic report printout, the example shows four-digit registers. A five-digit register size may be selected in the personality map when necessary for larger traffic reports.

OUTPUT FORMAT

8.02 The general form of the terminals response to an input command is given in Table G.

TABLE G
OUTPUT FORMAT

Initialization	CR LF DLY (optional)
Header	<HHMM b y1 ... y8 CR LF DLY
Typical Data Line	XXXXX b XXXXX b .... XXXXX CR LF DLY (Ten 5-digit registers)
Last Data Line (permissible)	XXXXX b ....XXXXX CP LF DLY (less than ten 5-digit registers)
Unit I.D.	AAAAA CR LF DLY
Terminator	ZZZ > CR LF DLY
Definitions	CR is ASCII "carriage return" LF is ASCII "line feed" DLY is 200 ms (min) delay < is ASCII "less than" HH is hours, tens and units MM is minutes tens and units b is ASCII "blank" or "space" Y1 ... y 8 is status register XXXXX is 5 ASCII decimal digits ZZZ is the checksum, discussed next > is ASCII "greater than"
Checksum	The checksum is three ASCII decimal digits equal to the least significant 8 bits of the binary sum of all the ASCII characters, excluding parity bits, transmitted by the terminal starting with and including the < character and ending with and including the last character preceding the checksum.

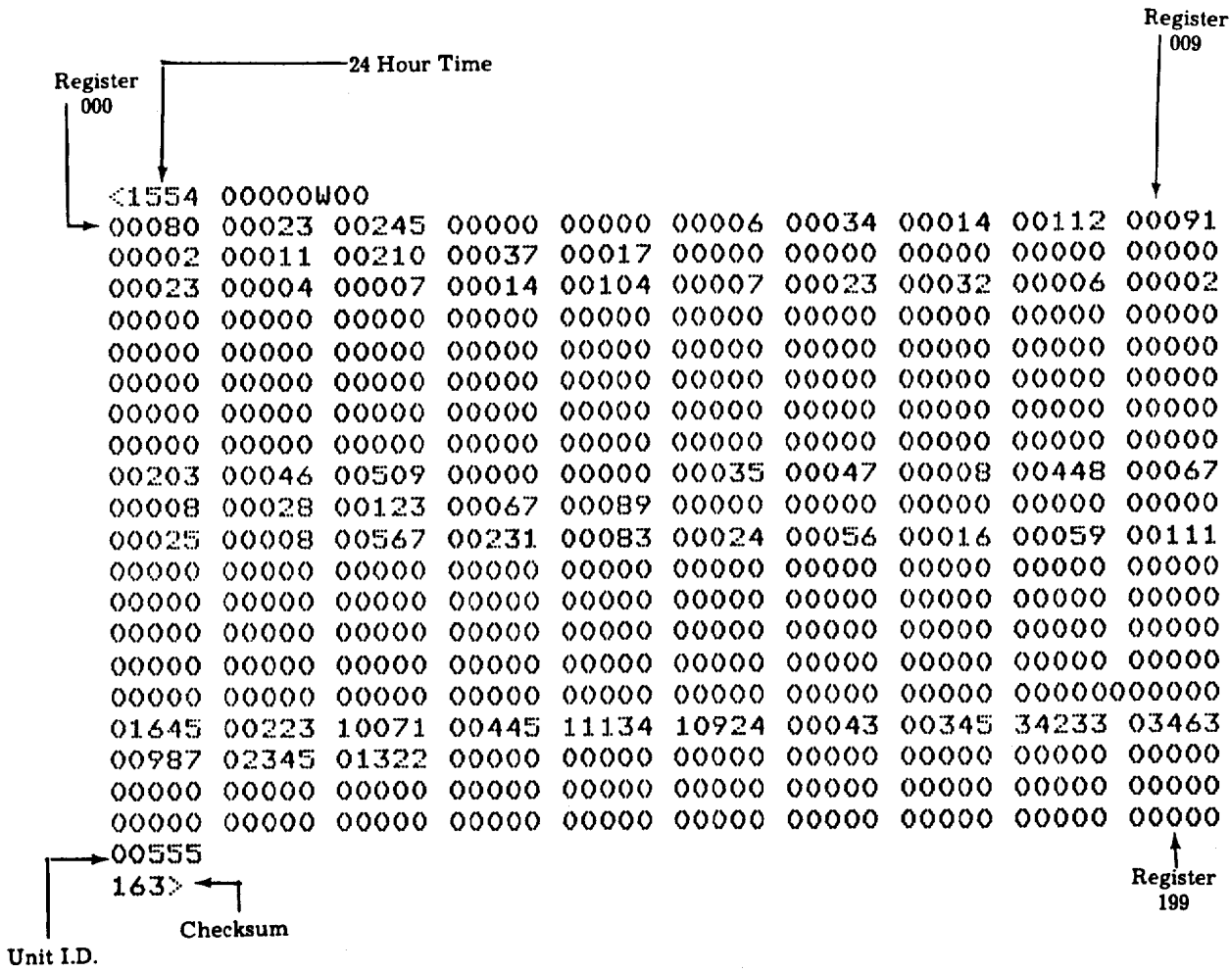


Figure III-3—Typical Traffic Report Printout

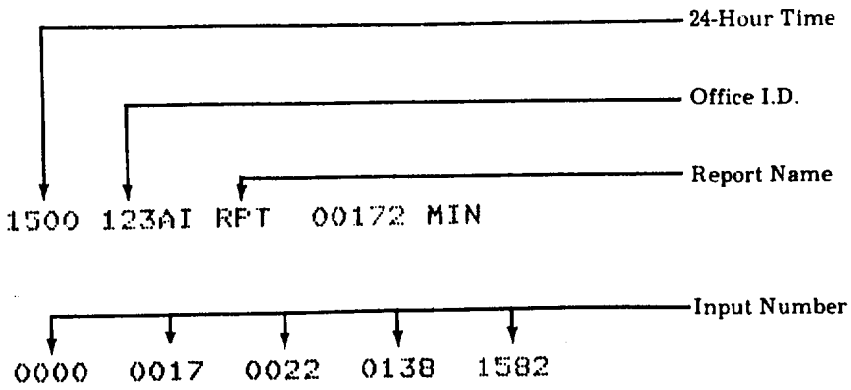


Figure III-4—Typical Maintenance Study Printout

9. MAINTENANCE STUDIES

9.01 The two types of maintenance studies that may be initiated are, always idle, or always busy. These studies provide a record of every input lead that is always in either an idle or busy condition. Always idle studies are initiated by the polling command C31E, and always busy studies are initiated by the polling command C32E. Studies continue until a new study is initiated. Printouts of the studies are made available by use of the polling command C33E. Figure III-4 is a typical maintenance study printout. A printout of "NO STUDY" indicates that a maintenance study is not in progress.

ALWAYS IDLE

9.02 When always idle studies are initiated, all input leads are scanned at a rate determined by the A and B scan rates as selected in the personality map. Any lead that goes busy during the duration of the study will no longer be included in the current study. In the example shown in Figure III-4, only five inputs (0000, 0017, 0022, 0138, 1582) were always idle during each scan.

ALWAYS BUSY

9.03 When always busy studies are initiated, all input leads are scanned at the A and B scan rates as before. Any input that is idle, or becomes idle, during the duration of the study, will no longer be included in the current study. If Figure III-4 were the results of an always busy study, the five inputs shown would represent lines that were always busy at the time of each scan.

10. MEMORY WINDOW (MODEL 966)

10.01 Most operation and test functions on the Traffic Recorder can also be initiated and displayed on the Memory Window. As shown in Figure III-5, the unit contains a 16-button keypad for initiating commands, and an eight-digit LED display for viewing the personality map data, active and passive traffic data, and individual input lead status. The following paragraphs describe the various command capabilities and displays available using the Memory Window.

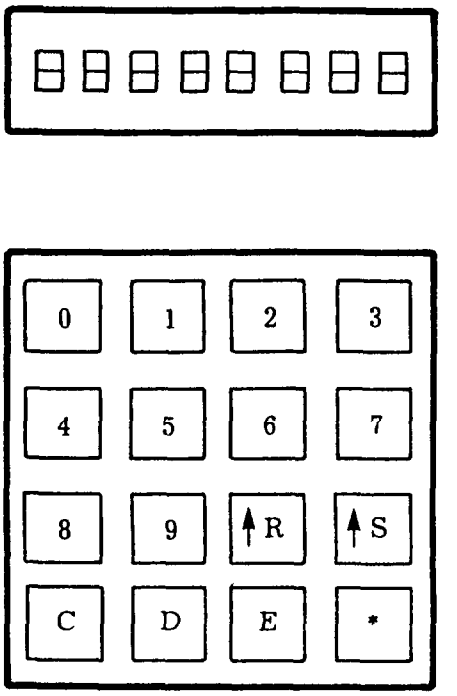


Figure III-5—Memory Window Keypad and LED Display

PERSONALITY MAP

10.02 The command for a personality map printout may be initiated from the Memory Window in the same manner as described in subsection 7. In addition, the contents of any one of the 629 personality map locations may be viewed using the Memory Window Unit. The command D4eee initiates the display command, where eee is the personality map location to be viewed. The display will appear as follows:

4.	e	e	e		d	d	d

The decimal is a flashing separator (delimiter) between two forms of data, in this case, between the command number and the location number. The actual personality map data for the given location appears in the three segments designated ddd. The display will automatically be cleared by the initiation of another command.

ALTERATIONS TO THE PERSONALITY MAP

10.03 The correct method of entering alterations into the personality map using the Memory Window is described in the following step-by-step procedure:

Step 1: Use Control R to transfer from command mode to entry mode.

Step 2: Enter the number of the map location for which an alteration is required.

Step 3: Use asterisk (*) to transfer program so that actual alteration can be entered.

Step 4: Enter new personality map data.

Step 5: Use Control S to transfer back to command mode. Since Memory Window Keypad has no provision for entering a space bewteen locations, it is always necessary to return to command mode after each entry. This is true even when new data are to be programmed into the next successive location.

SELF TEST

10.04 The self-test functions described in subsection 2 of this section may be initiated by the Memory Window. The results on self-test, however, can only be obtained on a local teleprinter or through a data set.

POLLING COMMANDS

10.05 All of the polling commands listed and described in Table F may be initiated in the same manner using the Memory Window. In addition, there are several display commands that may be initiated and displayed on the Memory Window Unit. These commands are listed in Table H. The first digit of the LED display corresponds to the command number and is followed by a flashing seperator (delimiter). The delimiter appears when a blank space is not provided between two types of information. The display will automatically be cleared by the initiation of the next command.

TRAFFIC REPORTS

10.06 The Memory Window may be used to initiate a buffer transfer and to make print commands in the same manner as described in sub-section 8 of this section. In addition, the Memory Window Unit may be used to view the current data on any individual personality map register by using one of the four appropriate display commands listed in Table H.

MAINTENANCE STUDIES

10.07 For maintenance studies, the Memory Window may be used to initiate always idle or always busy commands, and may also be used to make print commands in the same manner as described in sub-section 9 of this section. In addition, the Memory Window Unit may be used to view the condition of any input lead by using the display command D51111.

TABLE H
DISPLAY COMMANDS FOR MEMORY WINDOW
(MODEL 966)

Command	Content	Format
1 2 D 6	Clock Time	6 _ _ _ h h m m
1 2 D 0 r r r	Short-term Active Memory	0. r r r. d d d d
1 2 D 1 r r r	Short-term Passive Memory	1. r r r. d d d d
D 2 r r r	Long-term Active Memory	2. r r r. d d d d
D 5 1 1 1 1	Individual Lead Condition	5. 1 1 1 1. _ □ N or 5. 1 1 1 1. □ F F
D 4 e e e	Personality Map Entry	4. e e e _ d d d

rrr = Register Number
dddd = Data Value (Four Digits)
1111 = Lead Number
□N = Lead Busy (ON)
□FF = Lead Idle (OFF)
eee = Personality Map Entry Number
ddd = Personality Map Data
hh = Hours
mm = Minutes

SECTION IV

THEORY OF OPERATION

Contents Page

1. GENERAL

1.01 This section contains the theory of operation for the Model 566 Traffic Recorder. Circuit information is also included for the Model 966 Memory Window. Schematic diagrams for the circuits are contained in Volume II of this manual.

2. GENERAL THEORY OF OPERATION

2.01 The Traffic Recorder contains three circuit boards consisting of the Modem/Power Supply Board, the Control Board, and the Input Board. Each unit requires one Modem/Power Supply Board, one Control Board and at least one Input Board. Additional Input Boards may be used (up to a total of 23) to increase the number of telephone trunks that can be monitored. See Figure IV-1 for functional block diagram.

2.02 The primary part of the unit is the integral, eight-bit CPU (Central Processing Unit). This device, when used in conjunction with the three 2K-by-8 ROMs (Read Only Memory) and the eight 4K-by-1 RAMs (Random Access Memory) become a miniature computer dedicated to the monitoring of telephone trunks and to the control of the input/output ports. The three 2K-by-8 ROMs are physically mounted on the Daughter Board portion of the Control Board and provide a storage capacity of 6K instructions. The eight 4K-by-1 RAMs provide 4K of temporary read/write memory for data storage.

2.03 In the basic operation of the miniature computer, the eight-bit CPU first sends instructions from program storage (ROM). For example, an address will be sent out of the address latch to enable a certain input lead to be read. The next instruction would be to actually read the particular lead. This process would be followed by an instruction to increment the short-term active register for that lead, if that lead is active, or go on to the next instruction if it is not active.

2.04 During basic operation of the system, the CPU first outputs a specific input address to the Input Board, reading the input that has been enabled. This process is done every 10 milliseconds for those leads that are defined in the personality map as being ones-grouped peg count inputs. For all other inputs the rate is determined by the A and B scan rates. The purpose of the digital filter circuitry is to record the previous status of peg count inputs during the 10-millisecond scan and determine if proper timing conditions occurred to cause a peg count output or, in the case of usage scanning, to merely feed through the condition of the input lead being addressed.

MODEM/POWER SUPPLY BOARD

2.05 The power supply is a switching regulator that converts telephone company (-) battery and ground voltages into +5, +12, and -12 volts, referenced to 20 volts below ground. These voltages are used to supply system logic power. In addition, the switch regulator also converts input voltages into +12, and -12 volts, referenced to ground, for the data set and local printer ports.

2.06 The modem and EIA circuitry converts serial data to FSK (Frequency-Shift Keying). Those data go to and from the UART

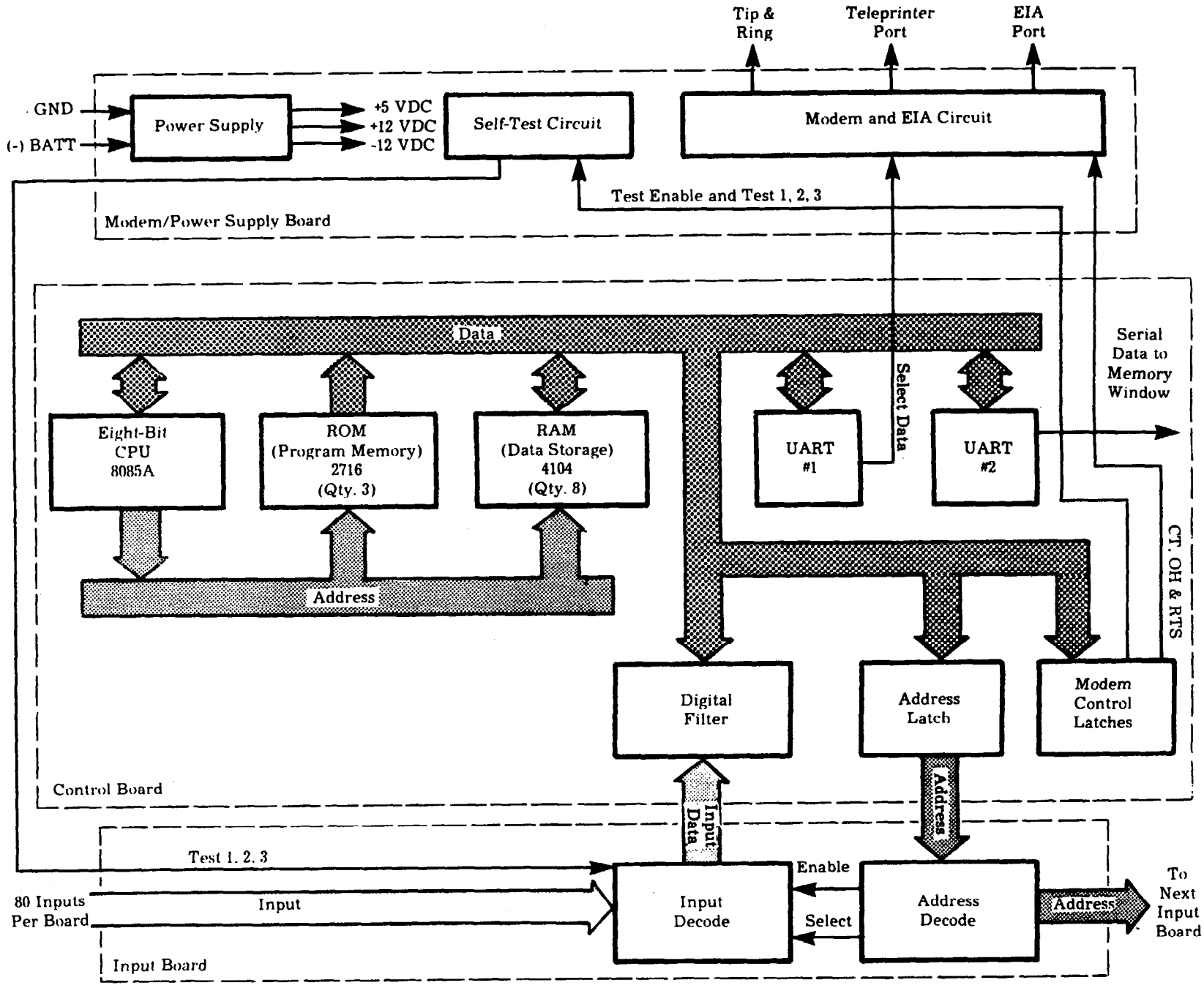


Figure IV-1—Traffic Recorder, Simplified Block Diagram

(Universal Asynchronous Receiver/Transmitter) controlled by the CPU. The modem and EIA circuitry also shift the level of serial digital data, referenced at 20 volts below ground, to digital data at ground reference for use by the data set and local printer.

CONTROL BOARD

2.07 As previously described, the eight-bit CPU sequentially reads and executes instructions stored in the three ROM chips. These instructions include the writing and reading of data to the 4K RAM chips, polling both UARTs to determine if data is available, reading or writing of data to the UARTs, setting an address to the Input Board latches, and reading the status of the input lead that has been addressed.

INPUT BOARD

2.08 Each Input Board is equipped with decoder circuitry to receive an address generated by the Control Board. This decoder also enables four inputs to be read by the processor. The decoder modifies the address and passes it along to the next Input Board, so that only four inputs in the entire system are ever enabled at any one time.

3. MEMORY WINDOW (MODEL 966)

3.01 The Memory Window is used for entering commands and for reading memory registers. The unit is a microprocessor-controlled device containing an 8035 microprocessor, a program memory, a keyboard for entering commands, LED display, and buffers to receive and transmit serial data. Under direction of its software, this device is continuously scanning the keypad circuitry looking for commands and updating information to the display. Output commands are transmitted serially to the Traffic Recorder. Input data received from the Traffic Recorder is accepted by the microprocessor and output on the LED display. Refer to Figure IV-2.

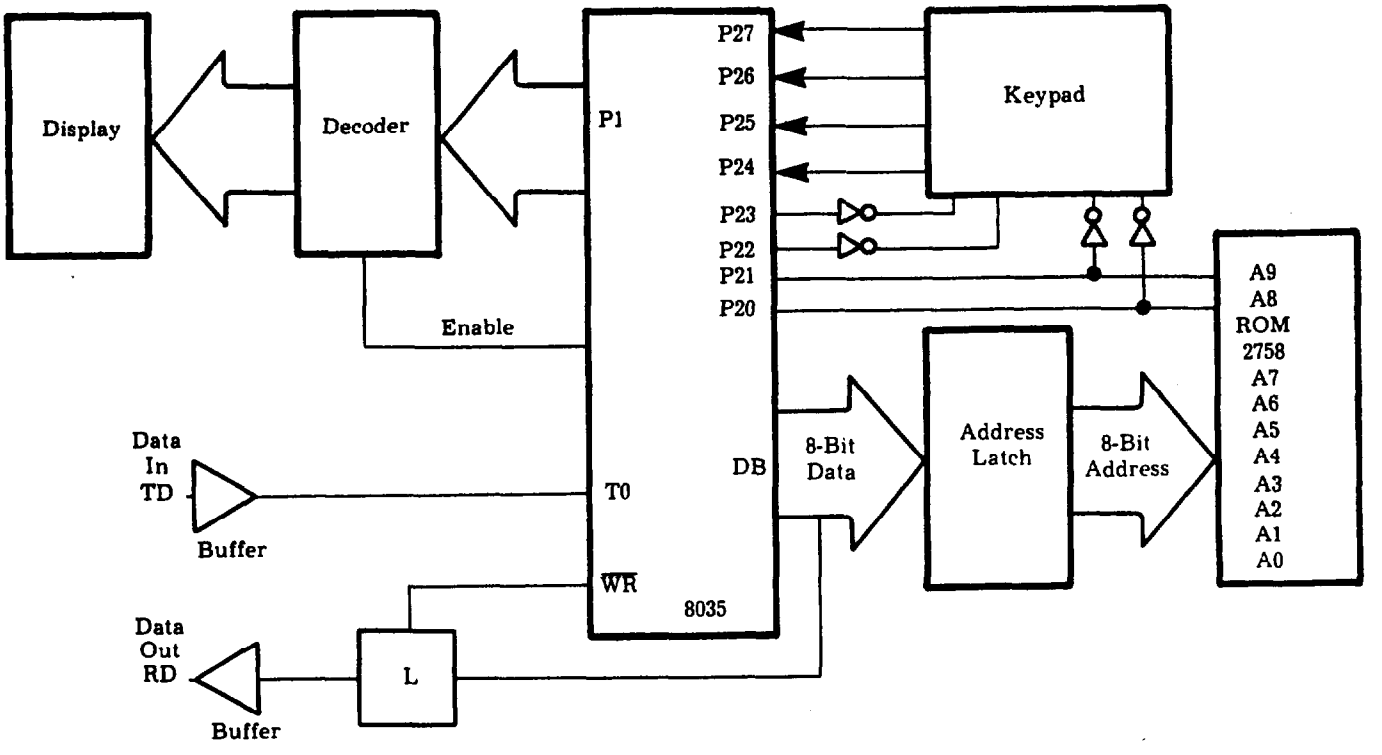


Figure IV-2—Model 966, Block Diagram

SECTION V

MAINTENANCE

Contents Page

1. GENERAL

1.01 The Traffic Recorder is totally solid-state and designed for continuous 24-hour service, therefore, little maintenance is normally required. The 2 amp fuse on the rear panel passes all unit power, and should be replaced with an AGC2 amp fuse in the event of a failure.

1.02 Since all components are mounted on printed circuit boards, it is recommended that malfunctions be corrected by replacement of the boards. This will enable a quick return to service of the Traffic Recorder. The procedures contained herein provide instructions for identifying and localizing malfunctions to a specific board. The malfunctioning board should be returned to the factory where specialized test equipment is available. Access to the board is obtained by removing the four screws that secure the front panel.

1.03 Since the fault isolation chart refers to the board by part number, Table I is provided to correlate part number with nomenclature, color code, and board location.

2. MAINTENANCE AND TROUBLESHOOTING

FAULT ISOLATION

2.01 Correction of malfunctions consists of three basic steps:

- Recognizing and identifying the fault
- Localizing to a specific board
- Replacing the board

CAUTION: Do not remove or replace any printed circuit board while the Traffic Recorder power is ON.

A. Control Board

2.02 The self-tests for ROM and RAM circuitry described in Section III will be useful in isolating failures in the Control Board. The Daughter Board containing the three ROM chips, can be removed from the Control Board and replaced when failures are isolated to the ROM circuitry. This provision would also apply for making program changes.

TABLE I
BOARD IDENTIFICATION AND LOCATION

Board	Part Number	Ejector Color	Position
Modem/Power Supply	385246	Red	4
Control	385247	Blue	7
Input	385240	White	9-32

B. Input Board

2.03 The self-test for input circuits described in Section III will be useful in isolating failures in the Input Boards. This test will printout the number of the first input lead where an error occurs. After replacement of corresponding Input Board, repeat input test to verify that error was corrected and that no other errors are detected on the remaining input lines.

TROUBLESHOOTING

2.04 Malfunction of the unit can be caused by incorrect installation, incorrect switch setting or by faulty boards. Refer to Table J Fault Isolation Chart. Scan the trouble symptoms for probable cause of failure. Call the Alston Customer Service Representative for assistance in locating difficult or intermittent problems.

TABLE J
TRAFFIC RECORDER FAULT ISOLATION

Symptom	Probable Cause
1. Unit will not turn on (power indicator LED does not light).	External fuse blown. Modem/Power Supply Board defective. Battery and ground wires reversed.
2. Erratic operation.	Modem/Power Supply Board defective. Intermittent connection on cables. Low main battery voltage (less than -43 VDC).
3. Clock drift excessive (greater than 90 seconds per week).	No connection to CLK SYNC terminal. Clock sync cable not connected to live 117 VAC outlet. 50/60 Hz sync switch not set correctly.
4. Garbled data on Port 1 and 2.	Baud rate switch not set properly; more than one baud rate selected at the same time; external data system not full-duplex, or data sets inoperative or incorrect. Control Board defective. Modem/Power Supply Board defective.
5. Teleprinter runs open (chatters).	System power off; TTY connection removed or incorrect; TTY not set for EIA.
6. No keyboard response to manual commands.	Same as 4 and 5 above, also incorrect setting of parity switch.
7. No buffer transfer.	Control Board defective.
8. Peg count data too high or too low.	Input signal response time switch set incorrectly and/or personality map register 629 has incorrect multiplier.
9. Incorrect peg count and usage (for 80 inputs only, or any multiple of 80).	One or more Input Boards are defective. Control Board defective, incorrect personality map definition.

TABLE J
TRAFFIC RECORDER FAULT ISOLATION
(Cont'd)

10. Incorrect peg count and usage (for all inputs).	Control Board defective.
11. RAM and/or ROM portion of self-test fails.	Control Board defective.
12. Input test portion of self-test fails.	If the first error was detected on lead 0000, 0001, or 0002, Modem/Power Supply Board, Control Board, or first Input Board defective (in that order). If first error was detected on lead 0003 or higher, corresponding Input Board defective.

SECTION VI

ACCESSORY AND PARTS LIST

Contents Page

1. GENERAL

1.01 This section provides a list of field-replaceable parts with an illustration to show their location in the equipment. An accessory list with recommended maintenance kits is also provided.

2. PARTS LIST

2.01 Field replaceable parts list is provided in Table K. Figure VI-1 illustrates the location of the parts listed in the table.

3. ACCESSORY LIST

3.01 Table L provides a list of accessories to be used with the Model 566/SONDS Traffic Recorder.

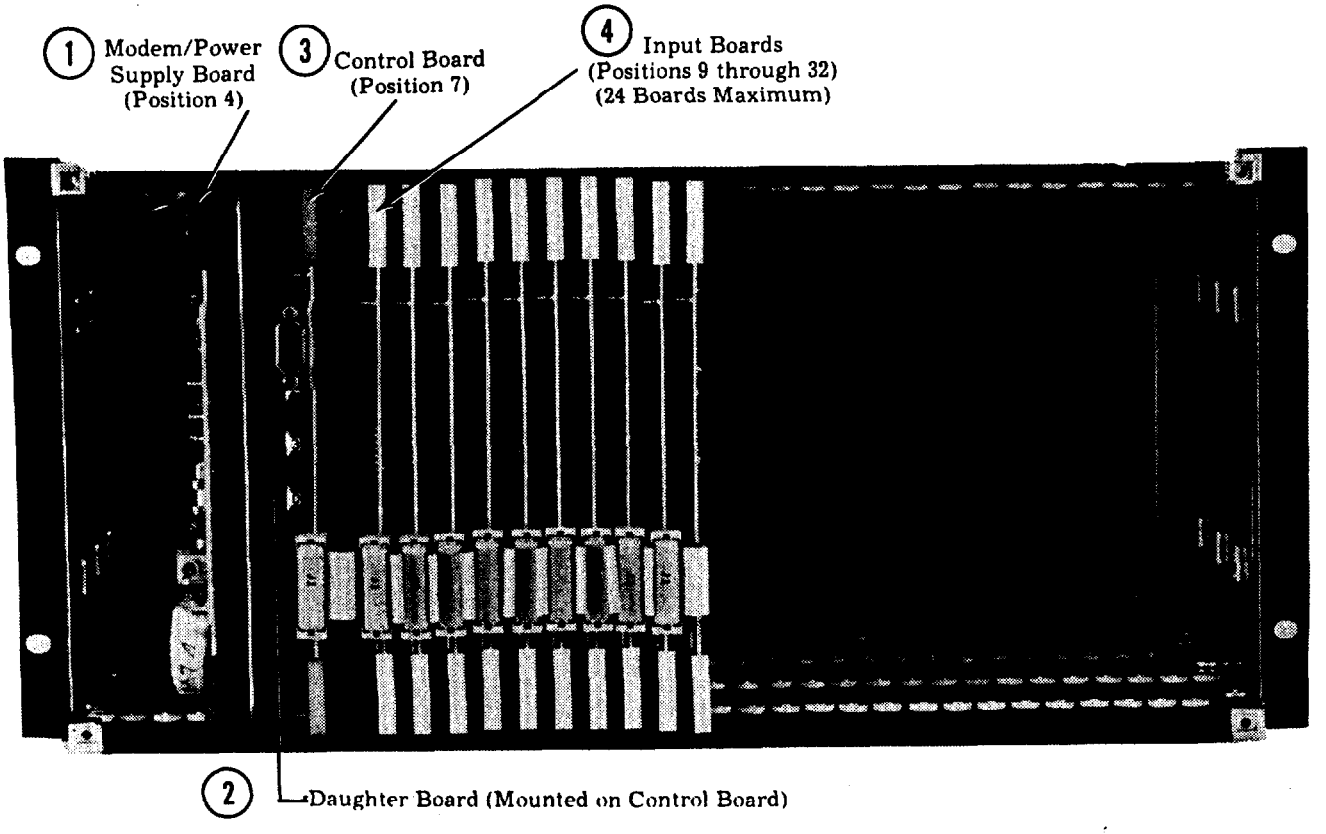


Figure VI-1—Traffic Recorder Parts Location

TABLE K
REPLACEABLE PARTS LIST

Figure Index Number	Description	Position	Part Number	Quantity
1	P.C. Board, Modem/Power Supply	4	385246	1
2	Daughter Board		365248-02	1
3	P.C. Board, Control	7	385247	1
4	P.C. Board, Input	9-32	385240	24 (Max.)
Not Shown	Clock Sync Cord		365106	1

TABLE L
ACCESSORY LIST

Nomenclature	Part No.	Function
Memory Window	80966	Provides for remote control commands and readout functions in the field.
Memory Window Cable	365658	Spare cable for Memory Window
Mounting Bracket, 23-inch	209675	Adapts Traffic Recorder mounting for a 23-inch rack (only one bracket required per unit).
Cable Support Assembly		Provides support bar for input cabling.
		Contents:
	209583-1	One each bracket mounting, cable tie (right).
	209583-2	One each bracket mounting, cable tie (left).
	209629-2	One each cable bar.
	8-32 X ¼ LG BHMS	Four each mounting screws.
Maintenance Kit	MK80566	Provides one spare circuit board for each type in system. Permits servicing by substitution of boards.
		Contents:
		One each spare circuit board as listed in Table J.
		One each spare AGC2 Fuse, 2 amp.

APPENDIX A

GLOSSARY OF TERMS AND ABBREVIATIONS

1. GENERAL

1.01 This appendix consists of definitions of terms or abbreviations used throughout the manual.

DEFINITION OF TERMS AND ABBREVIATIONS

Term or Abbreviation	Definition
ASCII	American Standard Code For Information Exchange
ATEMIS	Alston Traffic and Engineering Management Information System
AWG	American Wire Gauge
Baud	A unit of transmission speed of digital signals.
Byte	A sequence of adjacent binary digits operated upon as a unit and usually shorter than a word.
CCITT	Comte Consultatif International Telegraphe et Telephone.
Card Cage	A cabinet built to receive circuit boards. The boards fit into slots and mate with a connector at the end of the slot.
CPU	Central Processing Unit
CRC	Cyclic Redundancy Checks
EIA	Electronic Industries Association
FSK	Frequency Shift Keying
Hexadecimal	Pertaining to a numeration system with a radix of sixteen.
LED	Light-Emitting Diode
Modem	Equipment that connects data terminal equipment to a communication line.
Parity	Pertaining to the use of a self-checking code employing binary digits in which the total number of ONES (or ZEROS) in each permi: ible code expression is always even or odd.
Port	A connection from the Traffic Recorder to external auxiliary equipment for operating.
PROM	Programmable Read Only Memory
Peg Count	The number of times a telephone line is used.

DEFINITIONS OF TERMS AND ABBREVIATIONS
(Cont'd)

RAM	Random Access Memory
ROM	Read Only Memory
RS232C	EIA data interface specification.
TTY	Teleprinter
UART	Universal Asynchronous Receiver Transmitter
Usage	The amount of time a telephone line is used during a fixed period.

ALSTON DIVISION
CONRAC CORPORATION

ISSUE 6, April 1980

ALSTON WARRANTY AND SERVICE POLICY

1. MAINTENANCE PHILOSOPHY

1.01 Alston-manufactured products are designed utilizing modular plug-in circuit board construction. This technique allows customer maintenance by circuit board replacement. Troubleshooting to locate faulty circuit boards consists of utilizing symptom/probable cause troubleshooting charts found in the product manual, observing voltages and waveforms at various test points within the product, and substituting a known good circuit board from a maintenance kit for a suspected bad board. Telephone consultation and troubleshooting assistance is available by calling the Alston factory Customer Service Department at (213) 357-2121, Ext. 291.

2. MAINTENANCE KITS

2.01 Maintenance kits are available for all Alston-manufactured products. The maintenance kit contains at least one each of the various circuit boards used in the product, plus miscellaneous fuses, lamps, etc., all packaged in a convenient, containerized carton. On-site maintenance kits are recommended, as the circuit boards within the kit may be used as troubleshooting aids in locating defective circuit boards, in addition to use as an immediate replacement, thereby achieving very low mean time to repair (MTTR).

3. WARRANTY

3.01 Alston products are warranted as follows, except as may otherwise be noted for a specific product:

> "Alston Division of Conrac Corporation warrants each new product it sells to be free of defective material and workmanship and agrees to remedy or to furnish a new part in exchange for any part of such product which, under normal installation, use, and service, discloses such defect.
>
> "This warranty shall remain in effect on Alston-manufactured products for a period of one year after date of shipment and for non-Alston-manufactured products for 90 days after date of shipment. All items for repair or replacement under this warranty must be returned to the factory with shipment prepaid.
>
> "Alston will not be responsible for any loss, inconvenience or consequential damage caused by the product. This warranty is in lieu of any other warranty, obligation, or liability, expressed or implied, including any warranty of merchantability or fitness for a particular purpose."

4. REPAIR OF DEFECTIVE CIRCUIT BOARDS AND UNITS

4.01 Defective circuit boards, assemblies, or products should be returned shipment prepaid to the Alston factory location listed below:

> Alston Division
> Conrac Corporation
> Attn: Customer Service Department
> 1724 South Mountain Avenue
> Duarte, California 91010

4.02 The item should be adequately packaged with at least three inches of cushioning material (one inch for circuit boards) and should be accompanied with a note containing the following information:

- Part or model number of item
- Name of item
- Serial number of item (date stamp if a circuit board)
- Description of problem
- Name and telephone number of customer contact

4.03 Repaired items will be returned by "prepaid least expensive method." Return shipping charges will be paid by Alston for in-warranty items, and the customer will be invoiced at cost for out-of-warranty items.

5. ADVANCE REPLACEMENT SERVICE

UNITS IN WARRANTY

5.01 Alston may advance-replace defective circuit boards for Alston-manufactured products under warranty. There is no charge for this service, providing the defective board is received at the factory within 15 days following receipt by the customer of the advance replacement.

UNITS OUT OF WARRANTY

5.02 Alston may advance-replace defective circuit boards for Alston-manufactured products that are no longer under warranty for a period of four (4) years from the date of shipment. The charge for this service is 50% of the current list price of the replaced circuit board, providing the defective board is received at the factory within 15 days following receipt by the customer of the advance replacement.

5.03 The advance replacement procedure is as follows:

(a) Upon determining that a circuit board is defective, the customer should call Alston Customer Service with the following information:

(1) The part number and name of the board (this information is etched on the board itself).

(2) The model number, serial number, and any modification numbers of the unit from which the board was removed (this information can be found on the unit serial number sticker).

(3) A description of the trouble.

(4) For units out of warranty, a purchase order number against which the board will be shipped.

(b) Alston Customer Service will then arrange for a replacement board to be shipped. The replacement board will arrive in a reusable shipping container containing a return address label and a trouble tag.

(c) IMMEDIATELY fill in the trouble tag and attach it to the defective board. Pack the defective board in the reusable container, affix the return label, and return the package postage-prepaid to the Alston Factory.

(d) *IMPORTANT:* Failure to return the defective board within 15 days will result in an invoice for the advance replacement board in the amount of the full list price of the board.

6. REPAIR CHARGES

CIRCUIT BOARD REPAIRS

6.01 Out of warranty circuit boards returned to the factory for repair are repaired at a flat rate that is set according to the list price of the board at the time of return.

UNIT REPAIRS

6.02 Out of warranty units returned to the factory for repair are repaired on a time and material basis.

6.03 Repair cost estimates will be provided upon customer request.

6.04 All boards and units must be returned with shipment prepaid. Alston will not accept COD shipments. Alston will return the board or unit by best method, charges prepaid and billed.

6.05 Repair work to units or P.C. boards out of warranty is warranted for a period of 90 days.

7. FIELD SERVICE

7.01 Alston field service technicians are available. Consult factory for details.

8. TRAINING

8.01 Training classes on certain Alston hardware items are held periodically at the Alston factory training center. These courses cover operation and maintenance of the equipment. The charge for a training course will be provided on request. The customer must provide for his own travel and living expense. Class size is limited, and reservations are required. Contact the factory for details on available courses and scheduling.

9. INSTRUCTION MANUALS

9.01 One instruction manual is shipped with each product. Additional copies are available upon request for a nominal charge.

CONRAC CORPORATION

ALSTON DIVISION
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TWX: (910) 585-3240
Telex: 67-5328